New Application Predicts Ambulance Arrival Times

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PHOENIX — It's a common phenomenon in the emergency department—doctors and others gathered around the trauma room waiting for a critical call to arrive.

Often though, it is not known for sure when the ambulance will pull up to the entrance. In the meantime, work in the rest of the department backs up.

"It's a great waste of time when anywhere from 5 to 15 people are just standing around," said Dr. Ross Fleischman, an emergency physician at Oregon Health and Science University, Portland.

Dr. Fleischman and his colleagues at the university presented a promising solution at the annual meeting of the Society for Academic Emergency Medicine.

The team developed a computer application that links global positioning satellite (GPS) feeds on ambulances in Multnomah County—home of Portland, Ore.—to the Google Maps' estimated arrival time function application to predict when ambulances will pull up to the ED.

"We took that GPS data, which was just going to the dispatch center, and made it into an application where clinicians standing outside the trauma room will be able to use it," he said.

The model takes into account whether the ambulance is traveling during daylight hours or rush hour, both of which slow arrivals.

It also takes into account if the lights and sirens are on, which speeds arrivals, Dr. Fleischman's team found. Arrival times are displayed on a Web page.

In a proof-of-concept study, Dr. Fleischman and his colleagues showed that the application predicts arrival times within 5 minutes 75% of the time. That beats the usual method of relying on the estimated time of arrival from ambulance crews.

In an earlier study, the team found paramedics' estimated times of arrival to be accurate within 10 minutes 72% of the time.

Dr. Fleischman's model has not yet gone live. Accuracy was assessed by comparing actual transport times for 50,508 EMS calls in Multnomah County in 2008 with the model's predicted times.

The model was most accurate when ambulances were within a half hour of the ED; Dr. Fleischman expects the accuracy of the application to improve as it is further developed.

The next step is a real-time trial in which the GPS data for ambulances are constantly updated by live feed; accuracy of the predicted arrivals times should increase as the ambulance approaches the ED.

Coming up with the model was not too difficult, Dr. Fleischman said. Mark Lundquist, a medical student familiar with coding for Google Maps, worked out the program.

Dr. Fleischman said he expects a description of the system, as well as the coding, to be published within a year and implemented in his ED.

For those who do not want to wait that long, he is happy to share the coding with anyone who contacts him at fleischr@ohsu.edu.

Dr. Fleischman said he has no disclosures. The study had no outside funding. ■

TYGACIL® (tigecycline) Brief Summary
See package insert for full Prescribing Information. For further product information and current package insert, please visit www.wyeth.com or call our medical communications department toll-free at 1-800-934-5556.

INDICATIONS AND USAGE
TYGACIL is indicated for the treatment of adults with complicated skin and skin structure infections caused by *Escherichia coli*, *Enterococcus faecalis* (vancomycin-susceptible isolates), *Staphylococcus aureus* (methicillin-susceptible and -resistant isolates), *Streptococcus agalactiae*, *Streptococcus anginosus* grp. (includes *S. anginosus*, *S. intermedius*, and *S. constellatus*), *Streptococcus pyogenes*, *Enterobacter cloacae*, *Klebsiella pneumoniae*, and *Bacteroides fragilis*.
TYGACIL is indicated for the treatment of adults with complicated intra-abdominal infections caused by *Citrobacter freundii*, *Enterobacter cloacae*, *Escherichia coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae*, *Enterococcus faecalis* (vancomycin-susceptible isolates), *Staphylococcus aureus* (methicillin-susceptible and -resistant isolates), *Streptococcus anginosus* grp. (includes *S. anginosus*, *S. intermedius*, and *S. constellatus*), *Bacteroides fragilis*, *Bacteroides thetaiotaomicron*, *Bacteroides uniformis*, *Bacteroides vulgatus*, *Clostridium perfringens*, and *Peptostreptococcus micros*.
TYGACIL is indicated for the treatment of adults with community-acquired pneumonia infections caused by *Streptococcus pneumoniae* (penicillin-susceptible isolates), including cases with concurrent bacteremia, *Haemophilus influenzae* (beta-lactamase negative isolates), and *Legionella pneumophila*.

CONTRAINDICATIONS
TYGACIL is contraindicated for use in patients who have known hypersensitivity to tigecycline.

WARNINGS AND PRECAUTIONS
Anaphylaxis/Anaphylactoid Reactions
Anaphylaxis/anaphylactoid reactions have been reported with nearly all antibacterial agents, including TYGACIL, and may be life-threatening. TYGACIL is structurally similar to tetracycline-class antibiotics and should be administered with caution in patients with known hypersensitivity to tetracycline-class antibiotics.
Hepatic Effects
Increases in total bilirubin concentration, prothrombin time and transaminases have been seen in patients treated with tigecycline. Isolated cases of significant hepatic dysfunction and hepatic failure have been reported in patients being treated with tigecycline. Some of these patients were receiving multiple concomitant medications. Patients who develop abnormal liver function tests during tigecycline therapy should be monitored for evidence of worsening hepatic function and evaluated for risk/benefit of continuing tigecycline therapy. Adverse events may occur after the drug has been discontinued.
Mortality Imbalance and Lower Cure Rates in Ventilator-Associated Pneumonia
A study of patients with hospital acquired pneumonia failed to demonstrate the efficacy of TYGACIL. In this study, patients were randomized to receive TYGACIL (100 mg initially, then 50 mg every 12 hours) or a comparator. In addition, patients were allowed to receive specified adjunctive therapies. The sub-group of patients with ventilator-associated pneumonia who received TYGACIL had lower cure rates (47.9% versus 70.1% for the clinically evaluable population) and greater mortality (25/131 [19.1%] versus 14/122 [11.5%]) than the comparator.
Use During Pregnancy
TYGACIL may cause fetal harm when administered to a pregnant woman. If the patient becomes pregnant while taking tigecycline, the patient should be apprised of the potential hazard to the fetus. Results of animal studies indicate that tigecycline crosses the placenta and is found in fetal tissues. Decreased fetal weights in rats and rabbits (with associated delays in ossification) and fetal loss in rabbits have been observed with tigecycline [see **USE IN SPECIFIC POPULATIONS**].
Tooth Development
The use of TYGACIL during tooth development (last half of pregnancy, infancy, and childhood to the age of 8 years) may cause permanent discoloration of the teeth (yellow-gray-brown). Results of studies in rats with TYGACIL have shown bone discoloration. TYGACIL should not be used during tooth development unless other drugs are not likely to be effective or are contraindicated.
***Clostridium difficile*-Associated Diarrhea**
Clostridium difficile-associated diarrhea (CDAD) has been reported with use of nearly all antibacterial agents, including TYGACIL, and may range in severity from mild diarrhea to fatal colitis. Treatment with antibacterial agents alters the normal flora of the colon leading to overgrowth of *C. difficile*. *C. difficile* produces toxins A and B which contribute to the development of CDAD. Hypertoxin producing strains of *C. difficile* cause increased morbidity and mortality, as these infections can be refractory to antimicrobial therapy and may require colectomy. CDAD must be considered in all patients who present with diarrhea following antibiotic use. Careful medical history is necessary since CDAD has been reported to occur over two months after the administration of antibacterial agents. If CDAD is suspected or confirmed, ongoing antibiotic use not directed against *C. difficile* may need to be discontinued. Appropriate fluid and electrolyte management, protein supplementation, antibiotic treatment of *C. difficile*, and surgical evaluation should be instituted as clinically indicated.
Patients With Intestinal Perforation
Caution should be exercised when considering TYGACIL monotherapy in patients with complicated intra-abdominal infections (cIAI) secondary to clinically apparent intestinal perforation. In cIAI studies (n=1642), 6 patients treated with TYGACIL and 2 patients treated with imipenem/cilastatin presented with intestinal perforations and developed sepsis/septic shock. The 6 patients treated with TYGACIL had higher APACHE II scores (median = 13) versus the 2 patients treated with imipenem/cilastatin (APACHE II scores = 4 and 6). Due to differences in baseline APACHE II scores between treatment groups and small overall numbers, the relationship of this outcome to treatment cannot be established.
Tetracycline-Class Effects
TYGACIL is structurally similar to tetracycline-class antibiotics and may have similar adverse effects. Such effects may include: photosensitivity, pseudotumor cerebri, and anti-anabolic action (which has led to increased BUN, azotemia, acidosis, and hyperphosphatemia). As with tetracyclines, pancreatitis has been reported with the use of TYGACIL.
Superinfection
As with other antibacterial drugs, use of TYGACIL may result in overgrowth of non-susceptible organisms, including fungi. Patients should be carefully monitored during therapy. If superinfection occurs, appropriate measures should be taken.
Development of Drug-Resistant Bacteria
Prescribing TYGACIL in the absence of a proven or strongly suspected bacterial infection is unlikely to provide benefit to the patient and increases the risk of the development of drug-resistant bacteria.

ADVERSE REACTIONS
Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.
In clinical trials, 2514 patients were treated with TYGACIL. TYGACIL was discontinued due to adverse reactions in 7% of patients compared to 6% for all comparators. Table 1 shows the incidence of treatment-emergent adverse reactions through test of cure reported in ≥2% of patients in these trials.

Table 1. Incidence (%) of Adverse Reactions Through Test of Cure Reported in ≥2% of Patients Treated in Clinical Studies

Body System Adverse Reactions	TYGACIL (N=2514)	Comparators[a] (N=2307)
Body as a Whole		
Abdominal pain	6	4
Abscess	3	3
Asthenia	3	2
Headache	6	7
Infection	8	5
Cardiovascular System		
Phlebitis	3	4
Digestive System		
Diarrhea	12	11
Dyspepsia	2	2
Nausea	26	13
Vomiting	18	9
Hemic and Lymphatic System		
Anemia	4	5
Metabolic and Nutritional		
Alkaline Phosphatase Increased	4	3
Amylase Increased	3	2
Bilirubinemia	2	1
BUN Increased	3	1
Healing Abnormal	4	3
Hypoproteinemia	5	3
SGOT Increased[b]	4	5
SGPT Increased[b]	5	5
Nervous System		
Dizziness	3	3
Skin and Appendages		
Rash	3	4

[a] Vancomycin/Aztreonam, Imipenem/Cilastatin, Lev
[b] LFT abnormalities in TYGACIL-treated patients we in comparator-treated patients, which occurred n
In all Phase 3 and 4 studies that included a compa TYGACIL and 2.9% (105/3646) of patients receivin **observed across phase 3 and 4 clinical studies this increase has not been established. This inc options.** (See Table 2.)

Table 2. Patients with Adverse E

Infection Type	TYGACIL n/N	%
Approved Indications		
cSSSI	12/834	1.4
cIAI	40/1382	2.9
CAP	12/424	2.8
Combined	64/2640	2.4
Unapproved Indications		
HAP	65/467	13.9
Non-VAP[a]	40/336	11.9
VAP[a]	25/131	19.1
RP	11/128	8.6
DFI	7/553	1.3
Combined	84/1148	7.2

CAP = Community-acquired pneumonia; cIAI = Com skin structure infections; HAP = Hospital-acquired p pathogens; DFI = Diabetic foot infections.
* The difference between the percentage of patients
[a] These are subgroups of the HAP population.
Note: The studies include 300, 305, 900 (cSSSI), 301 (Resistant gram-positive pathogen study in patients (DFI with and without osteomyelitis).
In comparative clinical studies, infection-related seri treated with TYGACIL (7%) versus comparators (6%). frequently reported for subjects treated with TYGACIL between treatment groups in this subset of patients, established [see **WARNINGS AND PRECAUTIONS**].
The most common treatment-emergent adverse react the first 1 – 2 days of therapy. The majority of cases o were either mild or moderate in severity. In patients tr moderate, 1% severe) and vomiting incidence was 18
In patients treated for complicated skin and skin stru and 9% for vancomycin/aztreonam; vomiting inciden patients treated for complicated intra-abdominal infe for imipenem/cilastatin; vomiting incidence was 20% for community-acquired bacterial pneumonia (CABP), vomiting incidence was 16% for TYGACIL and 6% for
Discontinuation from tigecycline was most frequently
For comparators, discontinuation was most frequently
The following adverse reactions were reported infrequ
Body as a Whole: injection site inflammation, injection chills, injection site edema, injection site phlebitis
Cardiovascular System: thrombophlebitis
Digestive System: anorexia, jaundice, abnormal stools
Metabolic/Nutritional System: increased creatinine, hy
Special Senses: taste perversion
Hemic and Lymphatic System: partial thromboplastin t increased international normalized ratio (INR), thrombo
Skin and Appendages: pruritus
Urogenital System: vaginal moniliasis, vaginitis, leukor
Post-Marketing Experience
The following adverse reactions have been identified are reported voluntarily from a population of uncertain frequency or establish causal relationship to drug expo hepatic cholestasis, and jaundice.

DRUG INTERACTIONS
Warfarin
Prothrombin time or other suitable anticoagulation test [see **CLINICAL PHARMACOLOGY (12.3)** in full Prescrit
Oral Contraceptives
Concurrent use of antibacterial drugs with oral contrac

USE IN SPECIFIC POPULATIONS
Pregnancy
Teratogenic Effects—Pregnancy Category D [see **WARI**
Tigecycline was not teratogenic in the rat or rabbit. In p the placenta and was found in fetal tissues, including fe associated with slight reductions in fetal weights and a in bone ossification) at exposures of 5 times and 1 time respectively (28 mcg·hr/mL and 6 mcg·hr/mL at 12 and observed at maternotoxic doses in the rabbits with exp
There are no adequate and well-controlled studies of tig pregnancy only if the potential benefit justifies the poter
Nursing Mothers
Results from animal studies using ^{14}C-labeled tigecyclin lactating rats. Consistent with the limited oral bioavailab tigecycline in nursing pups as a result of exposure via m
It is not known whether this drug is excreted in human m should be exercised when TYGACIL is administered to a nu
Pediatric Use
Safety and effectiveness in pediatric patients below the a on tooth development, use in patients under 8 years of a
Geriatric Use
Of the total number of subjects who received TYGACIL in while 288 were 75 and over. No unexpected overall diffe these subjects and younger subjects, but greater sensiti ruled out.
No significant difference in tigecycline exposure was obs following a single 100 mg dose of tigecycline [see **CLINI**
Hepatic Impairment
No dosage adjustment is warranted in patients with mild Pugh B). In patients with severe hepatic impairment (Chil followed by a reduced maintenance dose of 25 mg every Pugh C) should be treated with caution and monitored fo and **DOSAGE AND ADMINISTRATION (2.2)** in full Prescri
OVERDOSAGE
No specific information is available on the treatment of o TYGACIL at a single dose of 300 mg over 60 minutes in h nausea and vomiting. In single-dose intravenous toxicity s median lethal dose (LD50) was 124 mg/kg in males and 106 mg/kg for both sexes. Tigecycline is not removed in s
This Brief Summary is based on TYGACIL direction circular

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